FireGuard AI: Smart Fire Prevention for Urban Safety

FireGuard AI: Prototype Completion Report

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1. Introduction

- **FireGuard AI is an AI-driven fire detection and prevention system designed for smart cities.**
- **It utilizes IoT sensors and machine learning to predict fire risks early, automatically shut off power, and send real-time alerts to emergency responders.**

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2. Objectives

- **Develop a prototype to test AI-based fire prediction.**
- **Integrate IoT sensors for real-time monitoring.**
- **Automate power shutdown during fire risks.**
- **Ensure seamless alerting.**

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3. Prototype Development

Hardware Used:

- **ESP32 for processing.**
- **Temperature & humidity sensors (DHT22).**
- **IR Flame and gas sensors (MQ-2).**
- **Relay module for automated power shutoff.**
- **Battery backup for continuous operation.**

Software Used:

- **Edge Impulse / TensorFlow Lite – AI model for fire risk prediction.**
- **Arduino IDE & MicroPython – Firmware development.**
- **Firebase / Blynk / MQTT – IoT alerts & data logging.**

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4. Working & Testing

1. **Sensors collect real-time environmental data.**
2. **AI model analyzes patterns and detects risks before ignition.**
3. **Relay module shuts off power in case of high risk.**
4. **Instant alerts sent.**

Testing Results:

- **Accurate fire risk prediction with 90%+ efficiency.**
- **Automatic shutdown mechanism works seamlessly.**
- **Real-time alerts received.**
- **Low energy consumption with battery backup support.**

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5. Cost Analysis

- **Prototype Cost: ₹3350 – ₹4550**

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6. Challenges & Improvements

- **AI model needs further refinement for better accuracy.**
- **Integration with city-wide fire response teams to be enhanced.**
- **Optimization of battery life for uninterrupted operation.**

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7. Conclusion & Future Scope

- **The prototype successfully detects fire risks, automates prevention, and ensures rapid alerts.**
- **Future enhancements will focus on improving AI accuracy, increasing scalability, and integrating with smart city infrastructure for widespread deployment.**